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DESIGN IN INDUSTRY FOR A DEVELOPING NATION

(Presented by the Government of
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GENERAL INTRODUCTION

Design which is the highest form of engineering practice is the pure outcome of creative thinking.

It constitutes the most solid foundation for a healthy and lasting industry and makes the industry capable of achieving continuous development by depending mostly on her own inward resources whether it is manpower, capabilities or general facilities.

This does not necessarily rule out certain dependency on foreign sources but at least it helps to dispose those uneasy feelings that force themselves on those who are responsible for the development of industrial problems in a developing nation. This is particularly the case if the foreign help is not so readily available at hand or if older nations are not so apparently willing and co-operative, a case which is not an unfrequent happening with certain matters and subjects.

Design is in fact an art which must be pursued and practised from the first moment a nation decides to go in the field of industrialization.

It, like any other art, requires long and arduous training combined with individual and personal abilities, readiness and zest.

The designers must be made and for this reason they must be given every opportunity to form and develop themselves. They must be provided with every scientific, technical and technological help from the very start of their career. They must be guided by older people who pass a great deal of practical experience. This guidance must be given for a long enough period to allow them to develop their self-dependency, self-reliance and confidence.

In the meantime those designers must be trained, first and foremost, in the art of dealing with foreign experts and they must be taught the correct methods and procedures which will help them to get from those

experts the best of their stored knowledge and experience without trouble or frustration. They should also be taught the techniques of accepting constructive criticism and the practice of close team-work procedures. Any effort or time spent in the correct achievement of these points can never be considered as too excessive or waste.

It is thus clear that all these pre-training steps require an appreciable duration in the early stages of industrialization of a nation and it becomes essential to proceed with design activities concurrently with the start of industry so as the nation will find her formed designers just at the time when her bought, ready made, factories begin to need their help and just at the time when the newness of these factories are worn out and their troubles begin.

These designers should also be given every opportunity to visit other more advanced nations to see for themselves how team work could be successfully carried out and achieved.

Before going further in detailing the making up of a successful design team or a design centre, it is appropriate to clearly define the concept behind the expression "Design in Industry".

This term has been chosen to replace the more commonly understood term of "Industrial Design".

The term "Industrial Design" has been purposely left out of this article to avoid the misapprehension that is liable to occur in the minds of the people of the old industrial world when they read it.

The expression "Industrial Design" is used by the old industrialization to denote an art of refinement to their existing product. In fact it is an art applied to improve and alter the shape of the product and add to it touches of beauty, streamlining and utility with an endeavour to improve on its economical production.

Thus to their hearing this expression which is in fact represents the advanced stage of our present design work might give them that erroneous feeling that we are trying to put "The Cart before the Horse".

What is Design in Industry

The word DESIGN can indicate such a broad field, it can mean the design of the technological process for a factory, the design of the structure that houses the factory, the design of the various equipments that constitutes the making up of a factory and which is generally termed the engineering design of the factory. It can also mean the design and planning of the site for the factory and its utilities.

In the first stage of design work in a developing nation it is advisable to limit the energy of the new designers to one specific field. In Egypt for the last four years we have been concentrating mostly on the design of equipments in all their various shapes, sizes and forms. We began with the simple bulky equipment such as tanks, vessels and their structures and continued with more intricate work as conveyors in factory transport and special purpose equipment. It has been a struggle against time where we have used every effort and driving power to make up for some of the lost time in that field. On the whole one can say that the bad effect of that short delay in our starting up of design pursuit in our case has been happily damped and offset by the circumstances that were available in our country in the field of Industrialization before the day of our Grand March On-to-Industry.

Though the available efforts at that time were very poor but nevertheless it formed a good stepping stone towards the field of self dependency in local production.

It was the duty of the central design administration which constituted an important division in the General Organization for Industrialization from the starting date of its formation four years ago, to strengthen then that poorly fed local jobbing factories with every possible design, drawing, or specification to make their job similar and more in-line with the modern ways that are followed in similar concerns in the old industrial nations.

The Importance of Design for a Developing Nation

Contrary to the general belief and to the common off-hand thought that passes through the minds of most people, our experience has shown without doubt that developing nations with newly established industries are more in need of design facilities than nations with completed and matured industrial structure.

The reason for such a statement is that the developing nation depends on design facilities to maintain their industrial existence by feeding their newly founded industries with their essential needs from worn parts when and where replacement are not available while the advanced industrial nations need their design facilities mainly and foremost for developments, improvements and solving new problems.

Again contrary to the common idea that design should start in the factory, experience has shown that in a developing nation design must start in a central design establishment. It is true that it can finally settle in the factory as the industrial structure of the developing nation gets more established and set.

To explain the reason for such a deviation from the common practice one has to ponder a little on the state of things and the multitude of difficulties the managerial group in a newly built factory face to up-keep the production at its required level. It would then be clear for anybody to see that if a developing nation wants to advance its design capabilities it has to incubate designers, at least during the first stages of industrialization, away from the scene of the factories but in full collaboration with them and to lighten the burden of the managerial staff of these factories by not putting this big responsibility of developing the art of design and designers on the shoulder of these over burdened group. Accordingly some one else should concentrate and devote all his time and effort to build up a suitable nuclei which could finally be sent over to these various factories to coagulate the specific experiences round them.

In so doing a developing country can successfully and in a short time support their quickly put up industries with the design facilities that have taken the older nations years of experience to achieve. In fact this is again a revolutionary way of overcoming these in-abilities suffered by the developing nations. It is about the only way that would hasten the speed of their independence in industry and insures an ever lasting successful industry strong enough to stand the hazards of the early stages of industrialization.

It is no wonder that we developing nations must resort to absolutely new revolutionary measures to make up for the lost time and to catch up with our older brothers in that respect and to stand side by side with them in the field of development and progress.

Before leaving the field of stressing the vital importance of the role that design play in a developing nation, we must consider the two following matters which play a big role in the economical stability of a nation:-

- a. The use of indigenous raw materials and the full utilization of local resources and in turn the increase of the volume of employment in all grades of industry.
- b. The suitability of foreign designs to the habits and natural instincts of the people in the developing nations.

It is absolutely clear that such items can never be successfully achieved unless the design thoughts and ideas emit from within the country and not from without. It is natural that the experience and knowledge of foreign experts must be sought in many incidents but it is the spirit and the instinct of the national designer that shall finally satisfy and succeed in attaining the highest percentage of achievement with regard to the above two items and in turn constitutes one of the most solid foundation for a healthy and well established economical development.

Thus it is clear that a team of well-trained designers standing side by side with the industrialists in a newly developing nation is a heavenly wealth which can provide quick solutions to their difficulties and problems and can save the disruption of their production. It is indeed the best friend the Industry can ever have in time of need and "A friend in need is a friend indeed".

Scope of Designs in a Developing Nation

In any developing nation there is always a certain amount of latent industrial capabilities which could be looked upon as an essential indigenous raw material and a national wealth and must be given top priority and attendance. Every effort should be made to strengthen and accumulate it rather than to leave it to disseminate in the winds and storms of the commencement era of industrialization. Thus it is the first duty of an industrial planner to develop such capabilities and to harness them correctly so as to extract from them that spark needed for igniting the field of local production in any developing nation.

There are more than one way of achieving such an aim and we shall mention here only some of them:

1. By grouping of such powers in various Industrial Estates and thus providing them with more incentive for good production and giving them the facilities needed for it.
2. By providing the small local job shops which may be existing in the country at the start of industrialization era with the technical know-how, then in maintaining the good quality of production through regular inspection and discussion sessions.
3. By encouraging the small scale and cottage industries and guiding them correctly through the media of good and new designs augmented by technical guidance.

In all the above cases the introduction of new ideas and improvements to the nationally practised and generally crude production must be made immense and wide programme for training and the establishment

of training centres and development institutes must be followed to ensure the continuity of the supply of technicians and technologists to every possible spot in the country. The speciality of these centres and institutes must naturally take the colour of the most predominant art in the districts where they are to be established.

These centres and institutes must not only concentrate on the practical training of trainees but must have a large portion of their activity devoted to the training of drafting and design techniques.

In fact this last subject has been so neglected in the developing countries that it has constituted the weakest link in the chain of development.

By following up the development of indigenous and national arts and abilities in the manner explained above the planner will find that he had opened for himself an extensive field of activity and has automatically promoted that important branch of feeding industries which is in fact the back bone of the successful industrial concerns.

Thus it is clear that through the activity detailed above if supported with well balanced designs and properly illustrated drawings the developing country can effectively succeed in fulfilling the following:

1. Solve her maintenance problems in all its mechanical fields whether it is power plants, factories, means of transport of any other mechanical commodity that it uses in every day life and existence.

These problems may include the change of designs of imported articles and commodities to suit the local investments and conditions or the solution of spare parts problems.

2. Energize the uses of indigenous raw materials because through design and drafting activities and the re-adaptation of imported items more local means and material could be utilized.

Establishment of a Central Design Office

As mentioned before it has been explained that one or more central design offices are essential to establish in a developing country. In what follows we are going to describe the best shape of such an establishment based on our experience.

First the established office must be in close contact with those organizational concerns who are responsible for the development of the industrial projects of the nation. It should be composed of two main divisions. One division for developing the designs and drawings while the other division should be for following up their local execution and manufacture must also have some sort of an establishment where he can try out and prove the designs made in the first division by building up a proto-type of part or of the whole of the design as the case may be.

The design division should be mainly composed of four sections, one for planning the procedures of the jobs through the centre and help in the designing of the technological process needed for the various jobs within its available capabilities and one for designing of the equipments, parts and various machines and one for designing the production and consumable goods and the fourth for designing the special tools, dyes, jigs and fixture needed for the production of the designed articles developed by the other sections. It should also be capable of working out the main steps needed for processing these designs through the various job shops.

The second main division of the centre should have three sections, one for inspecting the products during their manufacture and one for attending to general matters concerning the development of things within the centre and this should include the production of proto-types, training of personnel and it should maintain a well-developed information centre that could provide the designers of the first division with all the information whether practically, they need technically or technologically during the working out of their designs and the last section

would be for costing, cost control and for carrying out economical studies needed.

The administrative side of the centre must be given the usual attendance needed for good management and smooth running. The utmost care and diligence must be exercised to ensure the full co-operation and the continuous contact between one section and the other notwithstanding the various divisions of the centre.

In the meantime we must never forget the beating heart of the place where the drawing and drafting is finally prepared and duplicated. Strict ruling of order and time control must be always kept, a code of practice must be set up and every standard rule in connexion with the production of drawings must be understood by every member of that section and strictly adhered to.

No effort for training of its personnel should be spared and a continuous stream of trainees must flow out of the training division of that sector.

In this respect we would like to pause once more and repeat the importance of grading among drafting people, a matter which as we said before is liable to be neglected or misunderstood in a developing nation. The grades that must exist in that sector should be:

- a. The tracer
- b. The draftsman
- c. The senior draftsman
- d. The draftsman designer

These four grades are the back bone of industrial development and they must be kept in a healthy and well trained state.

The annexed diagram (1) shows the main outline of the organizational chart as described in this article.

Diagram (2) gives an outline of the shape of things in the prototype shop suggested to be annexed to the second sector of the centre.

Diagram (3): gives a general layout for such a shop and is being attached here for mere guidance to any interested party.

Diagram (4): gives details for some of the tasks each division of centralized design concern is supposed to carry out.

Diagram (5): gives an outline for the balance of informational guidance that should be made available to designers to ensure the availability of all scientific technological and practical knowledge needed for them in such a centre to help them to develop and consolidate their knowledge.

Annex (6): gives to interested parties a picture of the formation and the field of activities of the only central design administration established in the UAR since the year 1961. It also shows how the activities of such a newly established concern has grown so rapidly and is expected to grow further to cover bigger and wider fields of activities. It shows as well a tentative programme for its work in the coming five years.

Stages of Execution and Conclusion

It is important for the planner to consider the gradual growth of design abilities and not to over-push it but just push it forward with a speed harmonizing with the capabilities available at his hand. The resonance and harmony of work in such a centre are so vital to its success, and it is well to guard against - out of turn - notes and disturbances. It is expected that in such a place where creative thinking is the base of everything that development shall be slower than the speed of development in the industry itself. For this reason we stressed the point, at the beginning of this article, that the creation of a central design administration must start with the start of industry to give it time to ripen and develop and be ready at hand when the industry needs it few years after its own start. It should then be able to get over its own teething troubles before it is asked to solve the troubles of others. No effort should be relaxed and every help technical or technological should be made available to them.

To conclude this article it is well to summarize the main points that a planner should consider when planning to set up the central design concern in his country.

1. To consider the speed of the technical growth of his counter men and to plan to push design matters forward with a speed harmonizing with the capabilities at hand.
2. To set a lengthy and orderly programme for acquiring technical and practical help from foreign sources with an increasing resonance to harmonize with the widening of the field of design activity.
3. To define priorities and specific trends of activities and to begin by developing the existing national arts capabilities and to augment them gradually with other specialities which have the closest relation with indigenous materials and capabilities.
4. To prepare a long-term programme for the training and up-grading of personnel in the various specialities of the design fields so as to ensure the continuity of personnel supply in drafting and designing tooling and work processing.
5. To establish a proto-type and developing centre to support the design work by providing it with the practical atmosphere essentially needed for its proofing.
6. To work out the necessary plan that ensures continual emittance of designers to the various productive centres which would become the natural cause for coagulation design activities all over the country notwithstanding the state of industry whether being privately or state owned.
7. To promote the establishment of Industrial Estates which are to be supported by well documented products suitable for production within them whether these products are spares, national art or items needed for feeding bigger industries.

ANNEX

A General Note AboutThe Activities and Administrative Structure of G.A.I.D.

The General Administration for the Affairs of the Industrial Designs G.A.I.D. which in the past was shortly termed the Industrial Design Administration I.D.A. and which is a part of the General Organization for Industrialization G.O.I. is composed at the present time of two main "Sectors".

Each sector has a number of divisions termed administrations which are grouped in accordance with the nature of their work and duties. One sector is known as the "design sector" while the other is known as the "executive sector".

In the meantime the G.A.I.D. as a whole is virtually divided into separate divisions, each performing a certain speciality which shall be briefly detailed in the following.

The attached administration chart illustrates the whole set-up of the department.

G.A.I.D. is at the present administrated by a Director General and it is hoped that shortly he would be assisted by two assistants each administering one of the above sectors.

The "design sector" is composed of four administrations, one is specialized in the design of factory and general equipments which are in fact items, machines or parts of machines that are used in the production of our every day commodities and needs.

The term equipment in our understanding could mean material handling, agricultural and mining, storage and even those special machines and machine parts which are of enough simple nature that would make them suitable for production by our local facilities.

The second division of that sector is specialized in the design and development of engineering products which are being produced and need development or which are not being produced but could be introduced as additional items to existing factories. The shape and design of which would naturally be based on a similar established existing product.

The third administration in the design sector is entrusted with design of tools required for the production of designed items prepared by the first two divisions.

Accordingly, it shall be responsible for drawing up the sequential procedure of processing necessary for the production of the various items.

The fourth and last administration in that sector is termed the production planning division. It has a wide field of responsibilities as it is in fact responsible for planning the work for the three other administrations and its duties could be summarized in the following:

- a. During the course of contract negotiation with the successful tenderer for any of the projects of the plan, the personnel of this division would mutually agree with the supplier on these items that could be screened out of his bulk of supply and reserved for local production.
- b. They would then study in detail the specifications of the articles or items of equipment thus screened and either:
 1. Arrange for the preparation of their designs and drawings with the other divisions.
 2. Simply arrange to buy these designs and drawings from the tenderer and pass them over to other divisions to consider the necessity of supplying additional details or introducing any alternations or adding further remarks which would aid local producers to execute them successfully and utilizing as much as possible the indigenous raw materials and local facilities.

In other words to "translate them into the industrial language and terminology understood by the local job shops".

Naturally all above work is to be carried out with the approval of the supplier and without impairing the integrity or function of the article itself.

- c. To finally prepare the technical specification needed for the local tendering and purchase of the equipment.
- d. To help and advise local producers and factories, if so asked, in methods of improving their production procedures.
- e. To study site preparation for extensions of old factories.
- f. To act as liaison in the preparation of processes for new factories if it is felt that there is enough adequate technology exists in the country for such a process.

The second main sector of G.A.I.D. is responsible for the execution side of the problem.

It has to see that items designed by the first sector are produced to the standard of quality requested and in accordance to the agreed schedules.

It has also the responsibility of proving the designs where it needs proving and to try out the new ideas embodied in them before they are given out to Industry.

This sector of G.A.I.D. is composed of three main administrations.

The first is the inspection, progress and testing administration. It is responsible for carrying out the known duties in that respect.

The second administration is responsible for the working of the proto-type workshop whose duties shall be given separately later.

This section with its natural disposition and contacts with the market and local job-shops carry out a feed-back operation of market reflections, new technical developments in local facilities and thus provides the industrial information essential for the designers and other members of G.A.I.D. and Industry in General.

This division also administers the practical training programmes needed for the personnel of G.A.I.D. which shall naturally be centred on the proto-type shop.

The third and last division of this Sector is the economical survey and costing administration which controls market and economical studies, expenditure and cost accounting. It is also responsible for the general administrative matters.

One last remaining matter shown on the administration chart is the "project engineers" section which provides a very satisfactory co-ordinating service for the various projects handled by G.A.I.D.

The Prime Duties of the Proto-type

Workshop in Brief

The shop envisaged is to have the following characteristics:

- A- To be of general purpose type of workshop.
- B- It is not intended for regular production of items.
- C- It is not supposed to be independently capable of producing all the parts of an item or a product unless it is very simple; but it is supposed to order parts that are beyond its modest capabilities from other specialized concerns.
- D- It is expected to perform the following:
 1. Modelling work for new products in clay, wood and metal.
 2. Proto production work for a whole or part of an equipment containing a new idea, an alteration or a development which require proving.

The building up of a complex item is not considered possible here unless it could be affected by the collaboration and practical assistance of the interested manufacturer.

Thus this shop must contain in a general and moderate way the following facilities:

Machining and shaping.

Welding.

Assembling.

Testing and inspection.

Tooling for proto production.

With the above mentioned facilities such a shop could also produce geometrically reduced but functionally correct equipments for small pilot plant work to prove a newly designed idea or a process.

The shop is planned to house 65 personnel of different calibres but with especially high experienced technicians to satisfy the needs of the very special purpose they are expected to perform.

Such a shop, in our opinion, is an essential practical tool in the hands of new designers in a developing country where producing concerns lack the time, the facilities and the concentrated efforts to develop their own techniques in the early stages of their quickly built up industrial existence.

It shall open the way wide to young engineers, designers and draftsmen to practically see their ideas performed, it could also teach industrialists some of the new techniques of production which they would neither have the time nor the facility to perform or see otherwise.

It shall without doubt create a considerable effect on the national income and save an immense portion of the foreign capital used by the industry beside developing that side of practical thinking in the minds of the designers and draftsmen of the country.

Tentative Five Year Programme of Work

in the Proto-type Workshop

I- Equipment

In the field of equipments the following is expected to be attempted with the aim of executing three to five proto-types yearly.

1. One spinning machine
2. One weaving machine
3. One or two types of hand operated winches to check up the series which are to be designed as a semi-standard product for local production.
4. At least one wall-type crane for small lifts.
5. Various types of pulley blocks.
6. Standard products for power transmission as bearings, clutches, couplings, little gear units etc..
7. Reduced working models for overhead cranes with an aim of semi-standardizing them.
8. Reduced working model for a tower crane.
9. One set of hydraulic handling equipment.
10. Vibrating screens and similar mining equipment.
11. Agricultural implements as the specially designed plough for our soil disc harrow and other similar items.
12. A centrifuge.
13. A dough preparation machines for bakeries.
14. Helical conveyor
15. Large and small mixers.
16. A portable conveyor.

II- Pilot Plant Work

Also in the line of activities in trying out equipment for pilot plant work it is envisaged that the shop would carry out one to two such plants yearly. Enlisted work for study is:

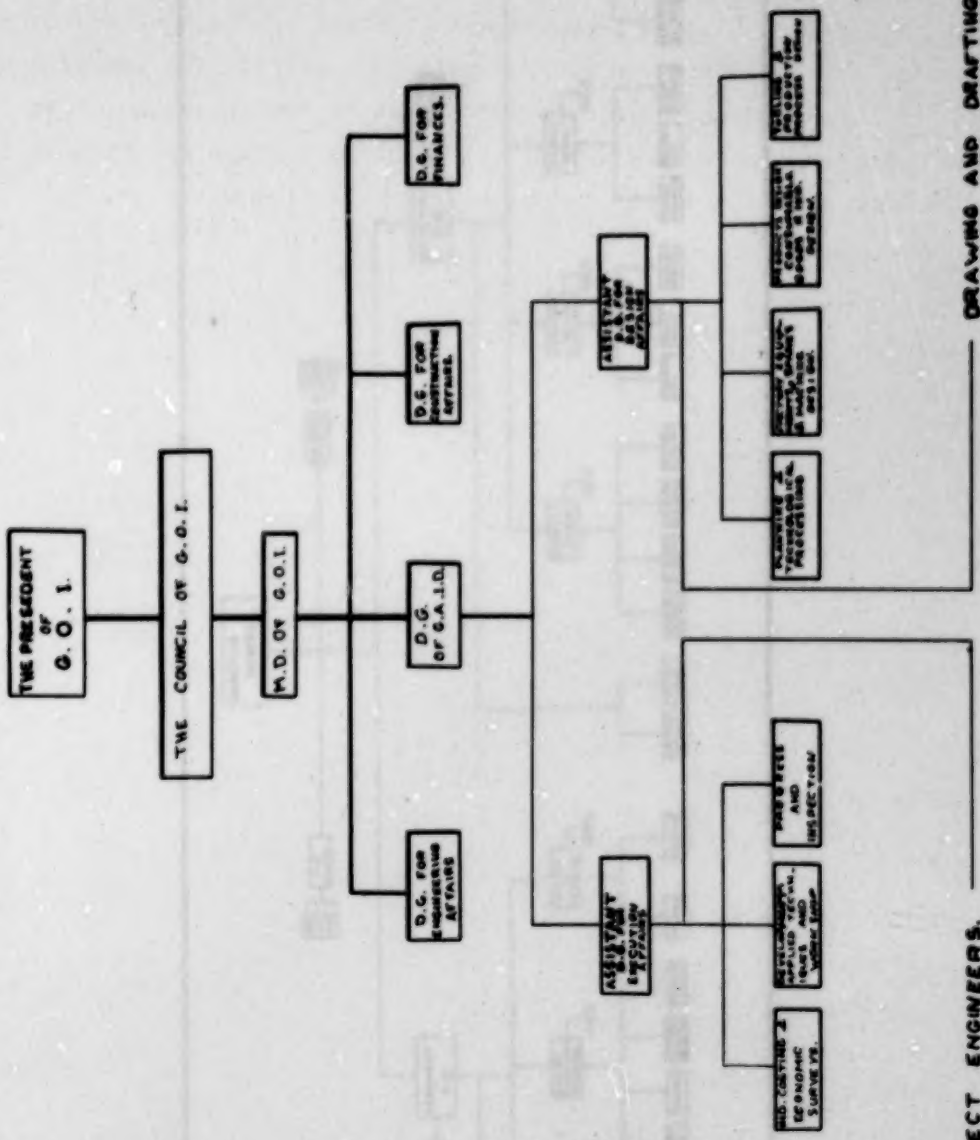
1. Aromatic oil extraction pilot plant.
2. General purpose oil extraction pilot plant.
3. Pilot plant for grading of local fruits.
4. Pilot plant for grading of vegetables.
5. Pilot plant for sugar extraction.
6. Pilot plant for pulp processing from the remains of various agricultural products.
7. Other unforeseen requests.

III- Products

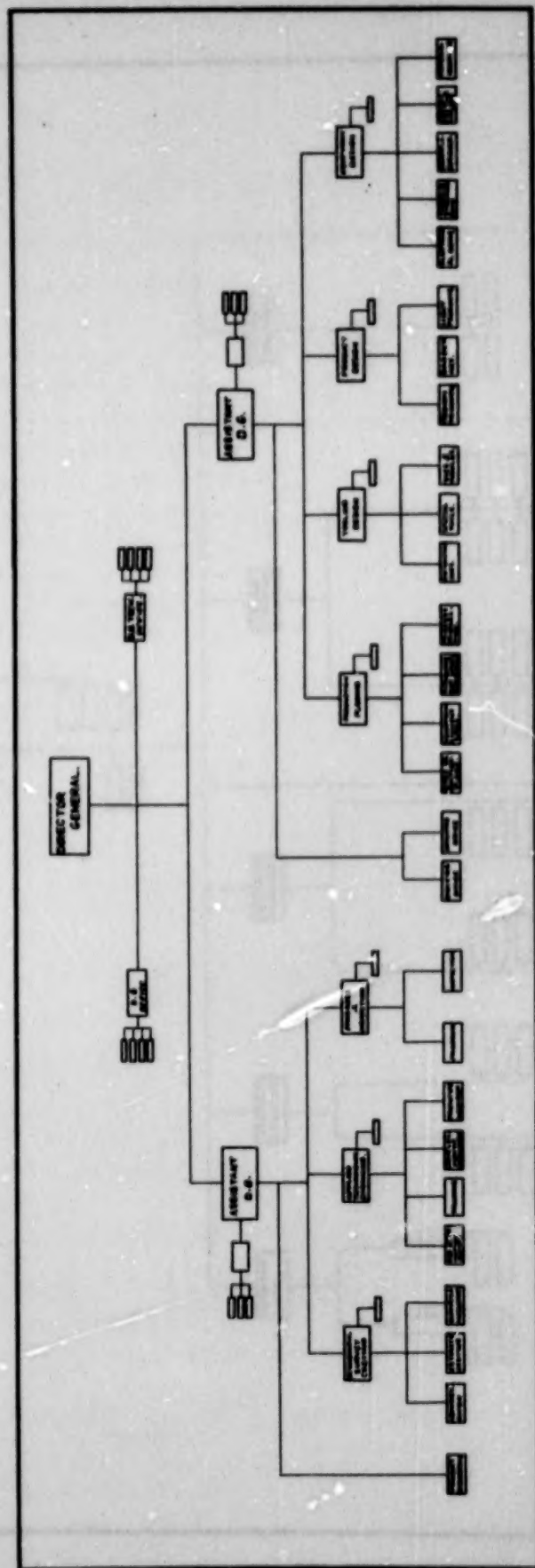
In the modelling and proto-type production line of products it is ambitiously estimated that the shop shall be capable of modelling and developing ten to fifteen articles yearly. A tentative programme for earmarked products are here-in-under detailed:

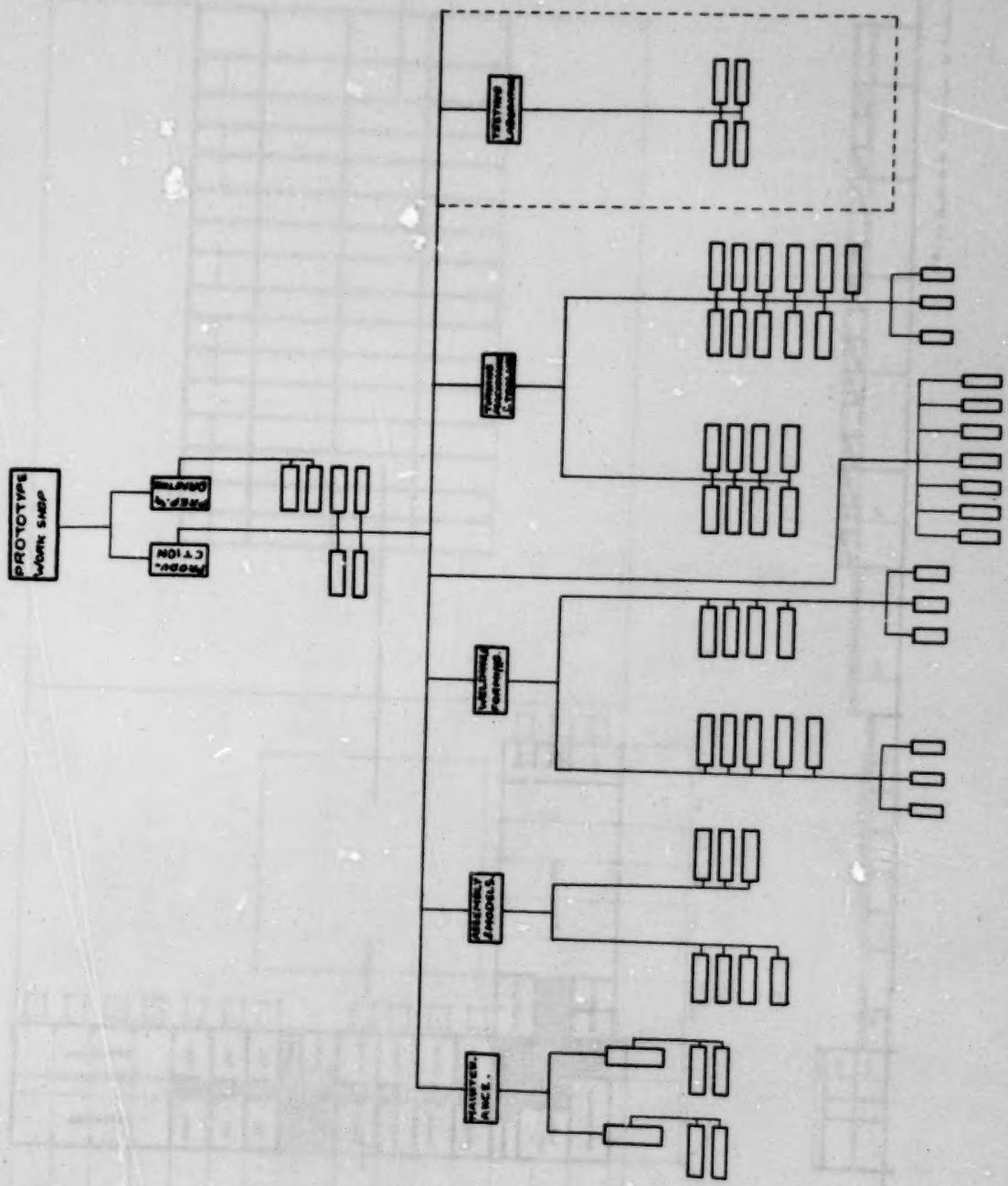
1. Battery driven trucks for goods transportation inside factories.
2. Battery driven trucks for other transport purposes.
3. Hand driven trucks.
4. Hand operated lawn mowers.
5. Engine or motorized lawn mowers.
6. Machine operated brushes for roadpavement cleaning.
7. Hand operated vacuum cleaners for domestic use.
8. Motorized vacuum cleaners for home and industrial uses.
9. Development of home electric irons.
10. Development of industrial ironing means.
11. Projectors and educational aids of similar nature.
12. Light fittings for factories general.
13. Light fittings for textile humidified factories.
14. Safety equipment.
15. Simple mechanical toys using the remains of industry.
16. Domestic mixers, dryers and similar products.

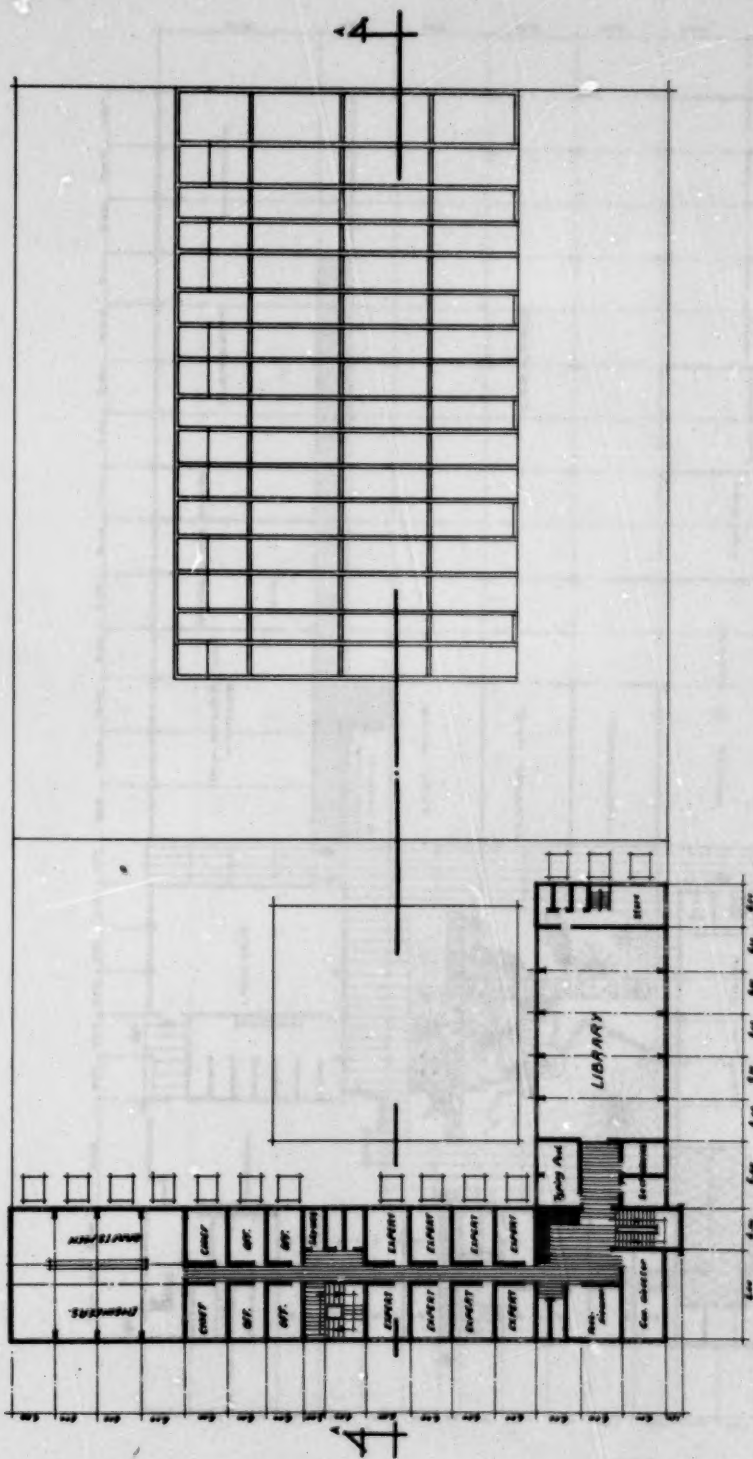
The scope of these products are so large and we have endeavoured to list the items that we would handle at a start. The yearly number at the first stages would range from five to ten products and as mentioned earlier we are ambitiously looking forward for fifteen towards the later stages when the technical staff reaches maturity.



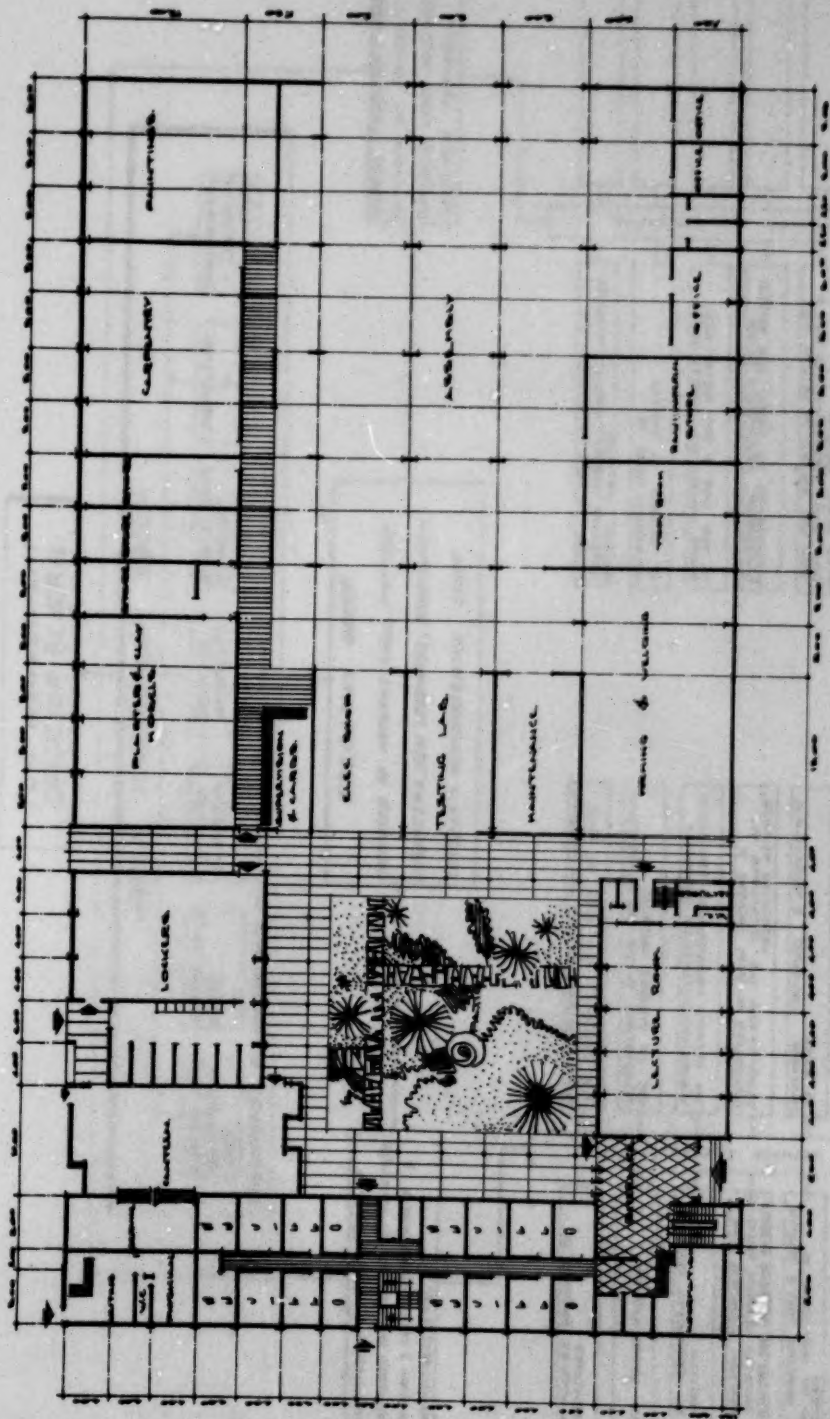
PROJECT ENGINEERS. _____ DRAWING AND DRAFTING.







W.B. is thought to be dominated by technologists.



TOP MANAGEMENT.
DIRECTOR GENERAL.

